Multi-Criteria Basis of Ecosystem Restoration and Management

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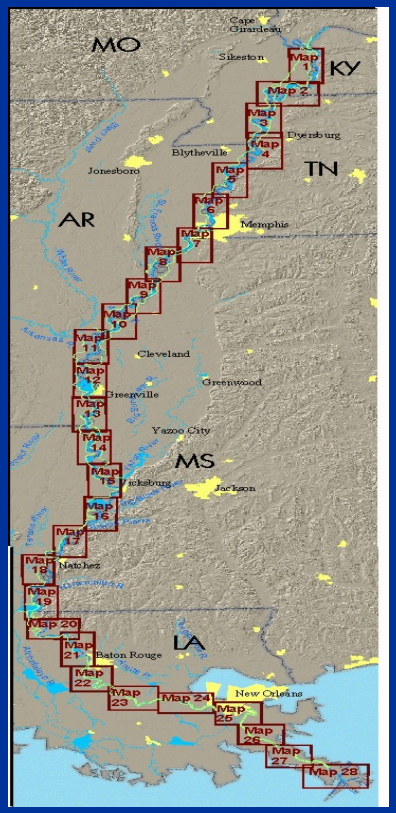

Lower Miss. River Projects, LMRCC

Winged Maple Leaf Management St. Croix River, WI

Middle Rio Grande Bosque Ecosystem Restoration, Albuquerque,

Points of Contact

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Middle Rio Grande River
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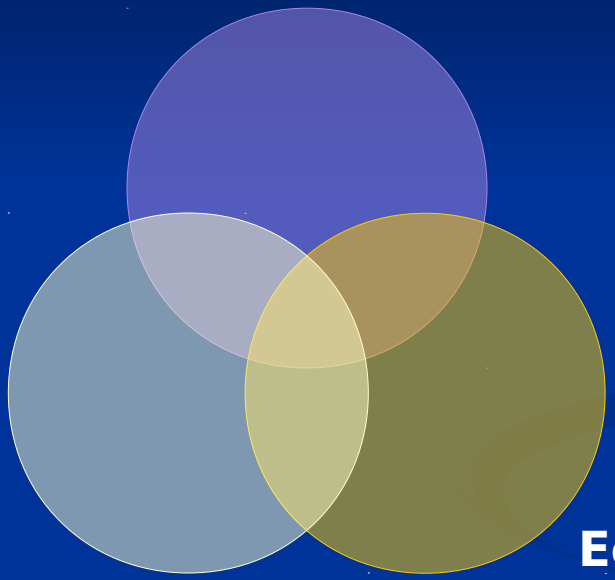
Multi-criteria Nature of Ecosystem Restoration and Management



Goals → **Objectives** → **Criteria/Indicators**

Adapted from International Union for Conservation of Nature and Natural Re
Society of Restoration Ecologists

Relating Goals to Objectives
(a few ecological examples)

Goal: Restore or rehabilitate degraded areas

Objectives:

- **Restore native populations**
- **Restore riparian recharge/hydraulic connectivity**
- **Restore habitats – quality and/or quantity**
- **Eliminate or minimize unnatural or human threats**
- **Eliminate or prevent alien invasive species impacts**

Ecological Criteria/Indicators

e.g.,
Target species abundance
Target population structure
Recruitment
Habitat structure and complexity
Community structure
Hydraulic connectivity

For each criterion, specifics must be provided on – Definitions, explanation of importance; how to meas and interpret data; existing data sources; key refere

Relating Objectives to Indicators (ecological example)

Goal: restore or rehabilitate degraded areas

Objective: enhance hydraulic connectivity

Associated Indicators:

Hydrologic connection of riparian swales

Connectivity of main channel to oxbows and borrow pit

Performance Standards

- Simple ratios using *selected* indicators: (observed value/desired value)

- One indicator may apply to multiple objectives

- Indicators vary in knowledge and measurement uncertainty

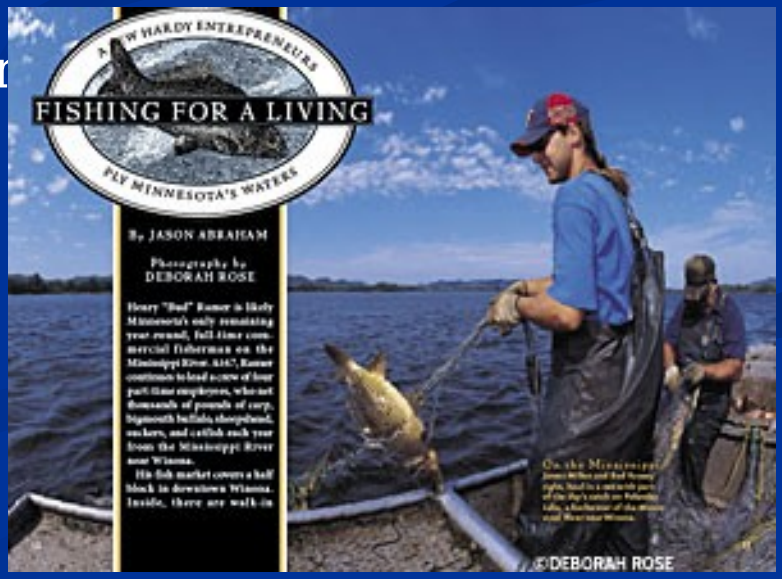
-Measurement difficu

-GIS compatible

Socio-Economic Goals

Livelihoods enhanced or maintained

- **Non-monetary benefits to society enhanced or maintained**
- **Benefits of restoration equitably distributed**
- **Compatibility with local culture maximized**
- **Environmental awareness and kn enhanced**



Socio-Economic Goals to Objectives to Indicators R

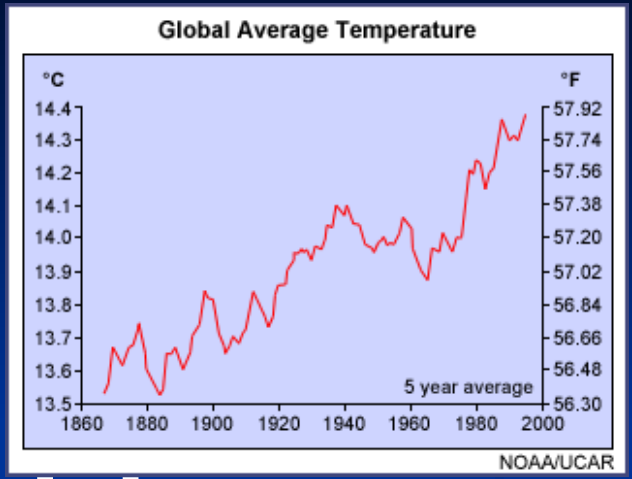
an example…

Goal: **Environmental awareness and knowledge enhanced**

Objective:
Increase recreation access/public awareness

***Associated Criteria/Indicator**
Boat ramps
Trails for birding, etc.
Overlooks/views

Sources of Uncertainty



"Big picture" sources

- Climate change
- Species invasions
- Human population shifts

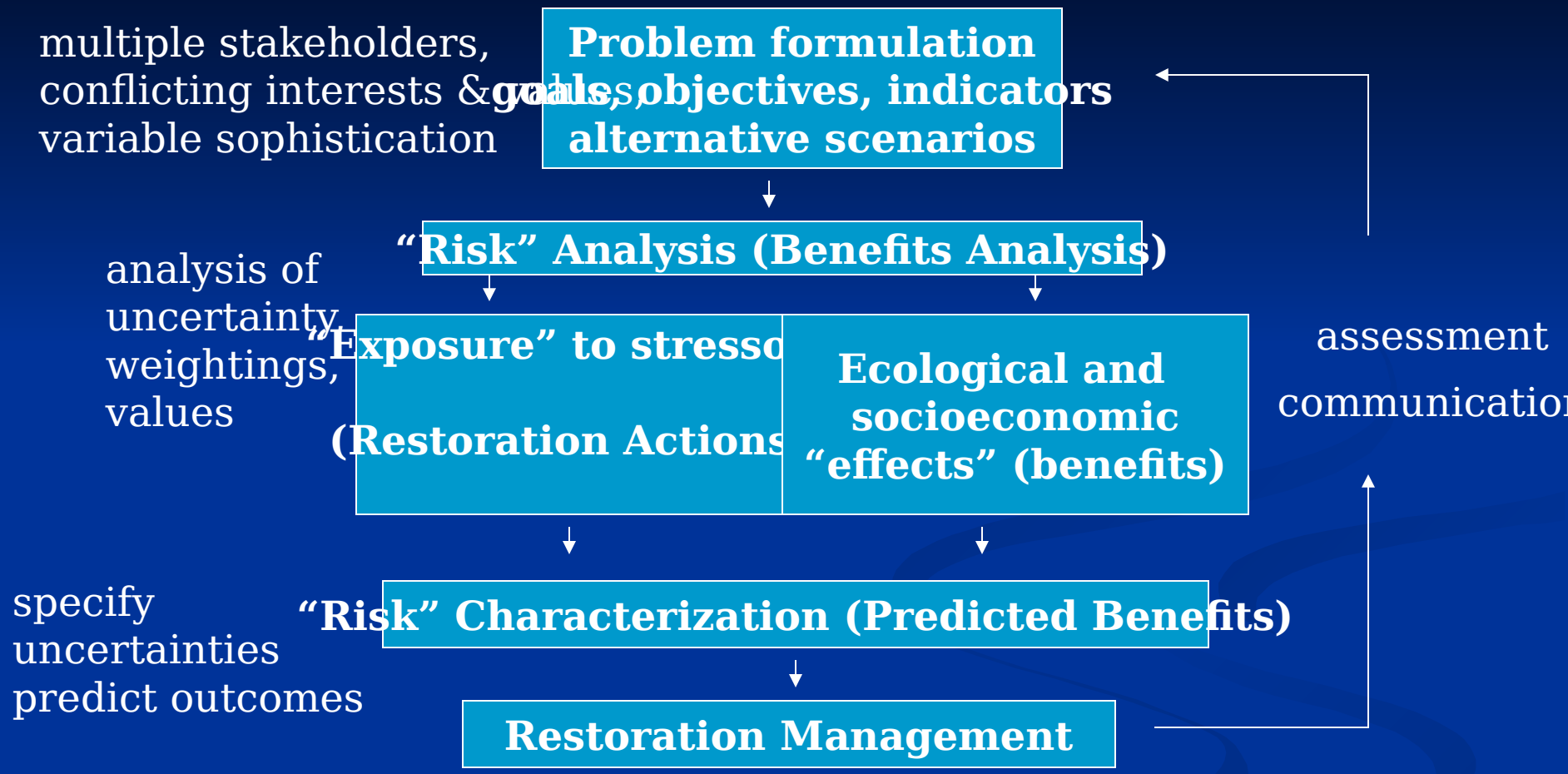
Incomplete information or knowledge

- Restoration science/engineering
- Adaptive management
- Goals-objectives-indicators

Measurement and statistical uncertainty

- Assessment and monitoring
- Qualitative vs. quantitative methods

Risk Assessment Paradigm Adapted to Ecosystem Restoration



Multiple Criteria Decision Analysis (MCDA):
aids common understanding, communication, alternatives comparisons, and management despite uncertainty

Heart of MCDA = Multi-Attribute Utility Function

For each evaluation criterion:

Importance (Weight) x Predicted Performance of Restoration or Management Measure

MCDA “decision score” is the sum of these products

Attributes’ weights are assigned by stakeholders (transparent, tractab
easily communicated

Measures’ performances are estimated using expert opinion, studies,
Models, etc. (inform decision in face of uncertainty)